

Space Weather Technical Forecast

Issued on Thursday, 02 December 2021 at 00:17 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Chance of G1/Minor Storm activity.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was very low, with no significant flares detected. There are currently three sunspot regions visible, with 2898 (Hsx/Alpha) and 2900 (Dao/Beta) in the southwest, both showing little overall change in the period. AR2902 (Cro/Beta) in the northwest remains relatively simple with only rudimentary penumbra at present. No Earth-directed CMEs were seen in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds, as measured by DSCOVR at L1, indicated high speed stream connection. Speeds were mostly around 500 km/s through the period with brief peaks near 570 km/s. Density was at average levels. Total IMF (Bt) was largely weak at 4-9 nT, with its north-south component (Bz) seeing negative (southward) between +/-8 nT but often negative/southward pointing. Phi angle was predominantly in a positive orientation (away from the Sun). Resultant geomagnetic activity was mostly at Unsettled to Active levels (Kp 3 to 4).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) remained at background levels. High energy electron flux (greater than 2 MeV) as observed by GOES-16 reached moderate levels through the diurnal peak on 1st at 672 pfu at 01/2220 UTC. The associated 24-hour integrated fluence remained well below the Active threshold (1e8 integrated pfu), and largely steady. Observed fluence at 02/0000 UTC was 9.659e6 integrated pfu.

Four-Day Space Weather Forecast Summary

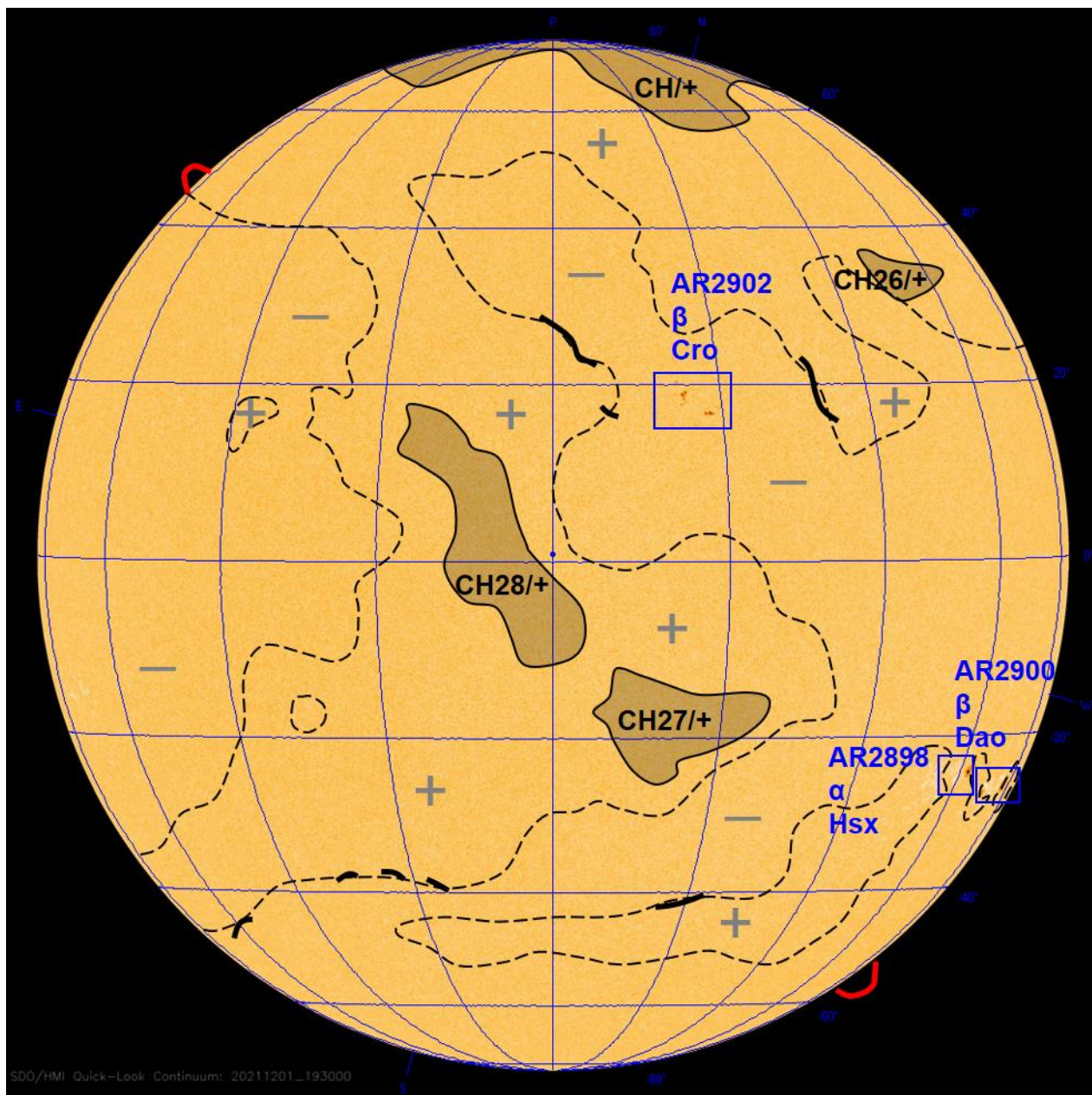
Solar Activity: Solar activity is likely to remain predominantly very low, with a chance of C-class flares, primarily from ARs 2898 and 2900 in the southwest.

Solar Wind / Geomagnetic Activity: Continued enhancements from various coronal hole fast winds are expected through the period, including CH26/+ initially on day 1 (2nd), then CH27/+ likely later on day 1 or during day 2 (2nd or 3rd), with lingering effects lasting into day 3 (4th), followed by a further possible connection with CH28/+ by day 4 (5th). A filament eruption which left the Sun on the 29th, may also bring a brief enhancement to solar winds during day 1 (2nd) from a glancing blow. Geomagnetic activity is expected to be mostly Unsettled, but with some Active spells, and a chance of G1/Minor Storm intervals, these most likely on 2nd and 3rd Dec, and perhaps the 5th.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at background levels. The high energy electron flux (greater than 2 MeV) is likely to begin at background to moderate levels, but with a rising trend and an increasing likelihood of diurnal maximums reaching high levels for much of the rest of the period. The associated 24 hour integrated fluence is also expected to show a rising trend, with an increasing likelihood of reaching the Active threshold (1e8 integrated pfu) as the period progresses.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

Figure 1. Solar Analysis Valid 01/2000 UTC.



Key: Filament — , Prominence — , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - $\beta\gamma$ - $\beta\gamma\delta$ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

A filament eruption which left the south centre disc of the Sun on the 29th may bring a brief enhancement to solar winds during 2nd December with a possible glancing blow, though the majority of the ejecta is expected miss the Earth. There are no other Earth directed CMEs in the forecast.

The solar wind parameters indicate connection with CH26/+ HSS continues. CH27/+ appears to be a more notable feature, and whilst its fast wind is not expected to arrive until 2nd or 3rd December, there is the potential for a strong solar wind (perhaps near 700 km/s, which has been observed from some coronal holes in the southern disc during the last month). Enhanced observed solar winds from STEREO-A on 29th may also indicate potential faster solar winds from this feature reaching Earth on 2nd. CH28/+, which was in previous days the rearward extension of CH27/+, is likely to become geoeffective by the end of the period, continuing the coronal hole influences on the near Earth space environment.

Consequently geomagnetic activity is expected to be mostly Unsettled, but with Active spells likely and a chance of G1/Minor Storm intervals, these most likely on 2nd and 3rd Dec, and perhaps the 5th.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	50	50	20	40
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
29/1553	/	Filament eruption	South centre disc	570 km/s	02/1800 +/- 12hrs	Generally south directed but glancing blow possible

Radio Blackouts - X-Ray Flares:

Flare activity is currently very low, with any enhancement to the X-ray flux most likely from ARs 2898 (Hsx/Alpha) and 2900 (Dao/Beta) in the southwest, although both likely to rotate around the west limb through this forecast period. AR2902 (Cro/Beta) in the northwest remains relatively simple with only rudimentary penumbra. Finally, far side data would suggest no significant regions expected to move into view around the east limb during this period.

Solar activity is likely to remain low or very low, with a chance of C-class flares, and a very slight chance of an M-flare.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES-16 is forecast to remain at background levels, with no solar radiation storms anticipated.

Radiation Storms	Level (cm ⁻² sr ⁻¹ s ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = cm⁻²sr⁻¹s⁻¹)

High Energy Electrons Event ($\geq 2\text{MeV}$):

The high energy (greater than 2 MeV) electron flux as observed by GOES-16 at GEO has been at background to moderate levels during the last 24 hours, but is now on a rising trend after connection to a faster stream of solar wind. Another potential enhancement is likely to be from the faster wind of CH27 later on day 1 (2nd), with an increasing likelihood of diurnal maximums reaching high levels for much of the rest of the period.

The associated 24 hour integrated fluence is also expected to show a rising trend, with an increasing likelihood of reaching the Active threshold through the period. This is supported by REFM which also reflects this trend, and forecasts Active fluence levels perhaps by day 3 (4th).

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	No	5	20	40	50
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	1

Figure 2: MOSWOC REFM.

